



# California's Petroleum Infrastructure Overview and Import Projections

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## Presentation Topics

- Petroleum infrastructure – key elements
- Crude oil – overview, production & import forecast
- California transportation energy demand
- Forecasted imports of clean products
- Petroleum infrastructure - significance to state
- Summary



# Petroleum Industry Infrastructure



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## Petroleum Infrastructure – Key Elements

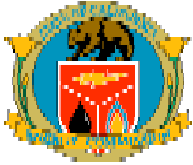
- The California petroleum “infrastructure” consists of several interconnected assets operated by a combination of refiner and third-party companies
  - Refineries
  - Pipelines
  - Marine terminals
  - Storage tanks
- Crude oil and petroleum product infrastructure assets are separate and distinct from one another – not interchangeable
- Unlike with the electricity distribution system, Northern California is not directly connected to Southern California



## Key Elements - Refineries



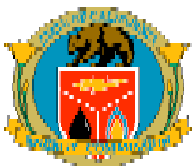
- 3 primary refinery locations
- 14 refineries produce transportation fuels that meet California standards
- 8 smaller refineries produce asphalt and other petroleum products
- California refineries provide majority of transportation fuel to neighboring states
- Limited petrochemical facilities outside the refineries



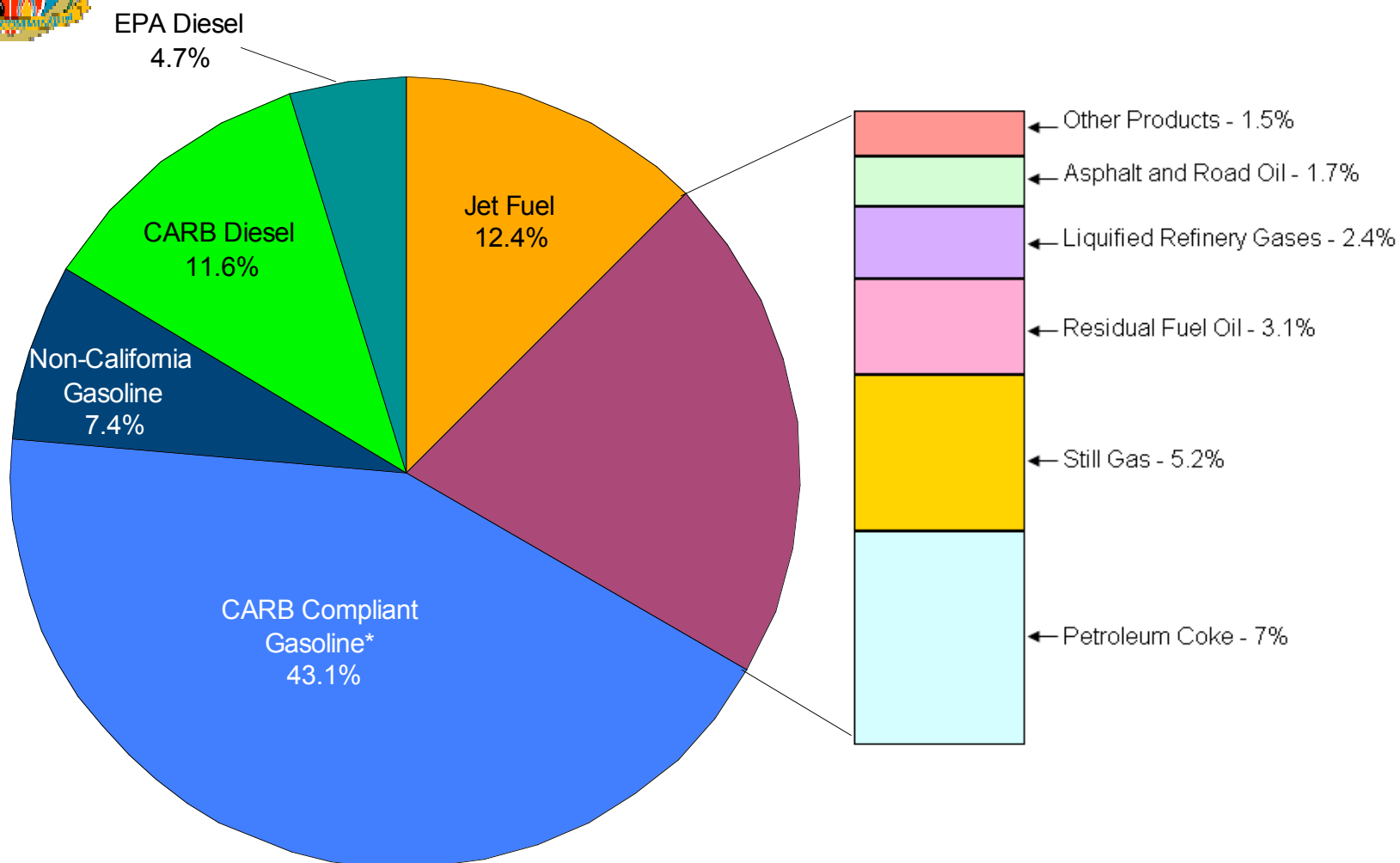
## Key Elements - Refineries



- Refineries are a primary hub of logistical activity
  - Raw materials imported & finished products shipped
- Crude oil is received by pipelines and marine vessels
- Process units operate continuously at or near maximum capacity, except during periods of planned maintenance or unplanned outages



## California Refinery Output in 2005 by Product Type



\*Note: Does not include ethanol.

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## Key Elements – Refineries

- Output from the refineries is usually placed in intermediate tanks prior to blending the finished products
- The majority of gasoline, diesel, and jet fuel is shipped from the refinery by pipeline to over 60 distribution terminals
- Most of the refineries dispense a smaller portion of their output into tanker trucks that are loaded at the refinery







## Key Elements – Pipelines

- Pipelines are used throughout the distribution infrastructure to interconnect key elements
- Intra-state pipelines are used to convey petroleum products within California's borders
- Interstate pipelines are used to export transportation fuels to Arizona and Nevada
  - NV – Nearly 100% of supply
  - AZ – Over 60% of supply
- Pipelines usually include pump stations, break-out tanks, storage tanks, and distribution terminals
- As is the case with refineries, pipeline systems normally operate on a continuous basis



## Key Elements – Marine Facilities

- Marine facilities are located in sheltered harbors with adequate draught to accommodate typical sizes of petroleum product tankers and crude oil vessels
- Wharves usually have adjacent storage tanks that are used to temporarily hold petroleum products prior to transfer to a subsequent location
- Most refiners operate a proprietary dock
- Third party storage provides access to majors and independents
  - Kinder Morgan
  - Pacific Atlantic
  - Chemoil
  - Petro-Diamond



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## Key Elements – Storage Tanks

- Storage tanks are vital to the continuous flow of petroleum products into and through California
- Tanks are located at docks, refineries, terminals, and tank farms
- Tanks serve different storage purposes:
  - Unload marine vessels
  - Receive pipeline shipments
  - Feed truck loading facilities
  - Hold inventories in advance of planned maintenance
  - Strategic storage that can be used for emergencies or periods of rapid price increases



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## Key Elements – Storage Tanks

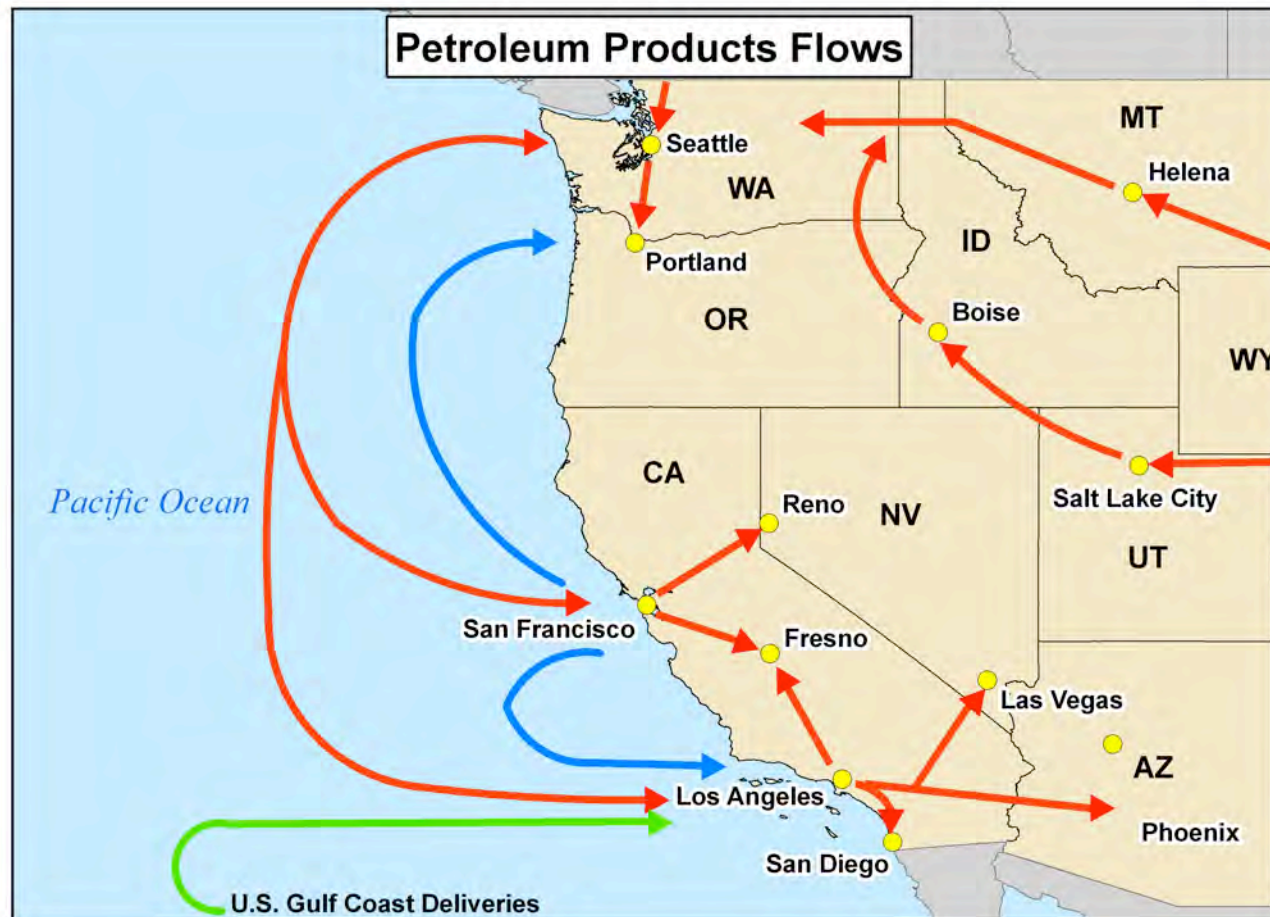
- “Dedicated” tanks are normally used for only one type of petroleum product
- “Drain dry” tanks can be used to store different types of petroleum products throughout the year, increasing versatility and flexibility for the distribution infrastructure
- Renovation of existing or construction of new storage tanks will be necessary to adequately handle the additional influx of imports foreseen over the next decade
- Most, if not all, of these projects will occur in locations with existing tanks



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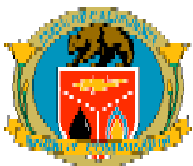


# Interstate Dependence for Transportation Fuel Supply

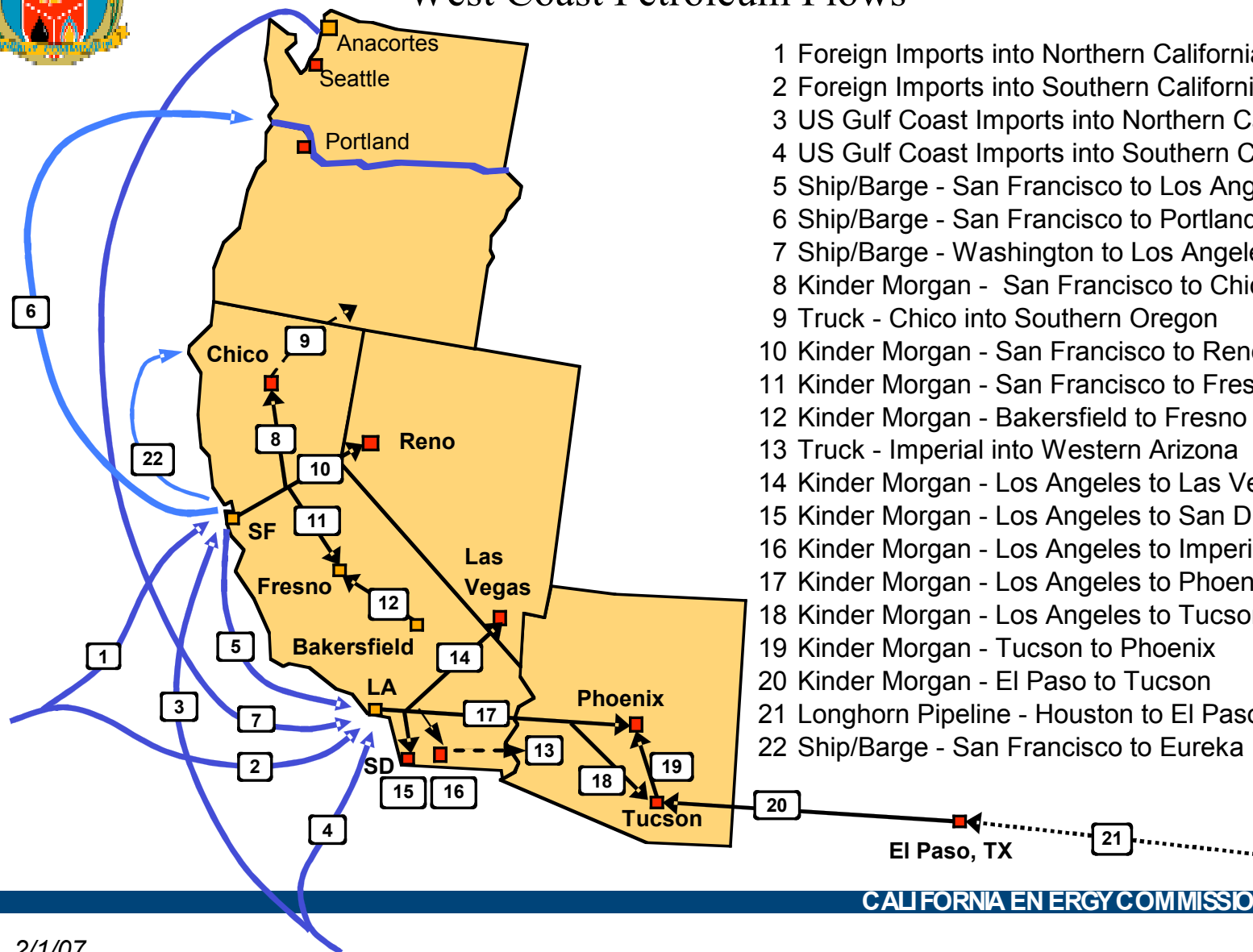


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## West Coast Petroleum Flows



- 1 Foreign Imports into Northern California
- 2 Foreign Imports into Southern California
- 3 US Gulf Coast Imports into Northern California
- 4 US Gulf Coast Imports into Southern California
- 5 Ship/Barge - San Francisco to Los Angeles
- 6 Ship/Barge - San Francisco to Portland
- 7 Ship/Barge - Washington to Los Angeles
- 8 Kinder Morgan - San Francisco to Chico
- 9 Truck - Chico into Southern Oregon
- 10 Kinder Morgan - San Francisco to Reno
- 11 Kinder Morgan - San Francisco to Fresno
- 12 Kinder Morgan - Bakersfield to Fresno
- 13 Truck - Imperial into Western Arizona
- 14 Kinder Morgan - Los Angeles to Las Vegas
- 15 Kinder Morgan - Los Angeles to San Diego
- 16 Kinder Morgan - Los Angeles to Imperial
- 17 Kinder Morgan - Los Angeles to Phoenix
- 18 Kinder Morgan - Los Angeles to Tucson
- 19 Kinder Morgan - Tucson to Phoenix
- 20 Kinder Morgan - El Paso to Tucson
- 21 Longhorn Pipeline - Houston to El Paso
- 22 Ship/Barge - San Francisco to Eureka

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# Crude Oil



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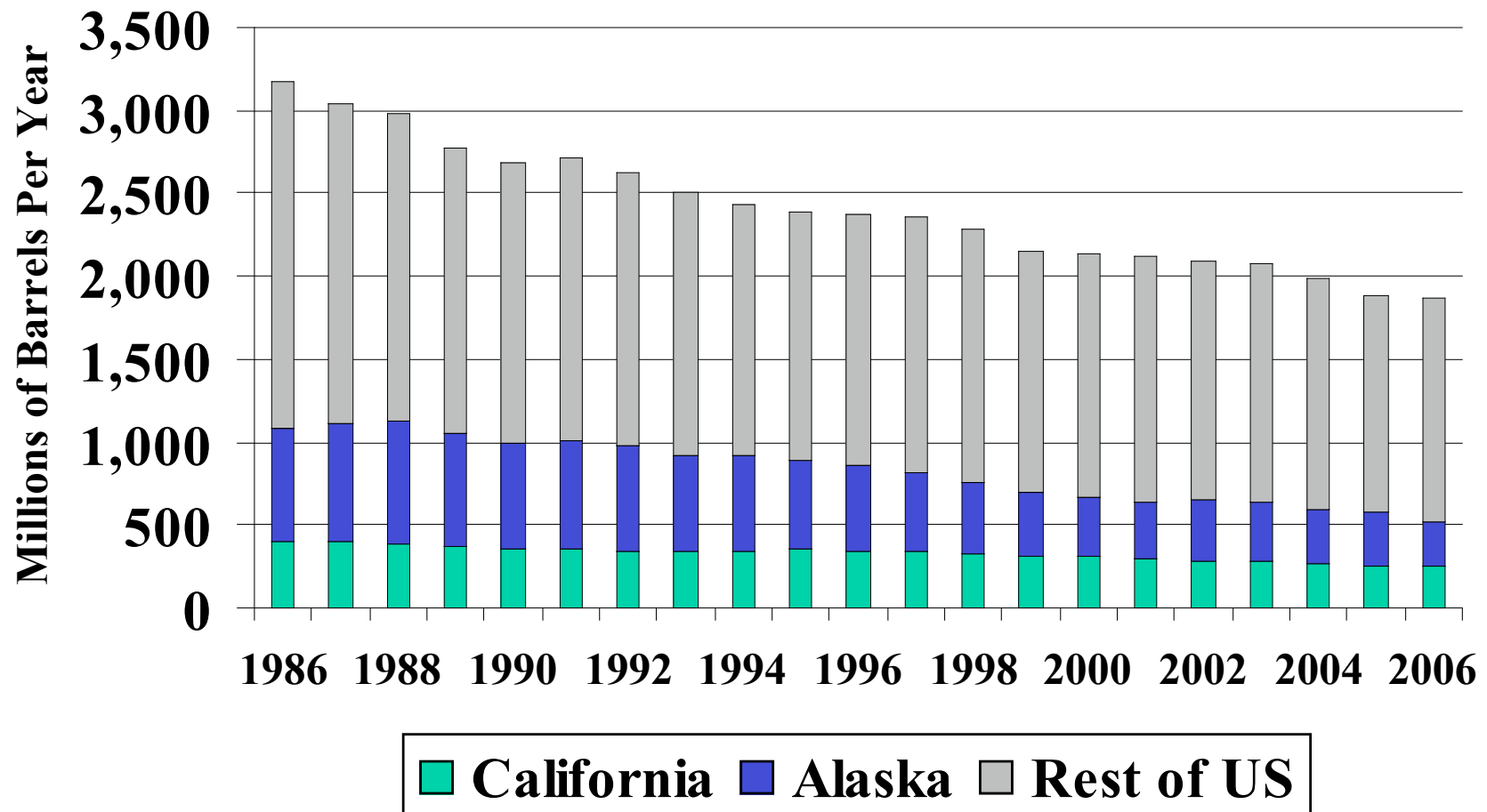


## Crude Oil - Overview

- Global demand for crude oil estimated at 84 million barrels per day for 2005
- U.S. refiners processed over 15.2 million barrels per day during 2005
  - Crude oil imports 10.1 million barrels per day or 66% of supply
- California refiners processed 1.8 million barrels per day during 2005
  - California 40% (729 TBD)
  - Foreign 40% (746 TBD)
  - Alaska 20% (372 TBD)
- Declining domestic production will be replaced with foreign crude oil delivered by marine vessel & pipeline
- Crude oil processing by refineries expected to gradually increase, referred to as “refinery creep”



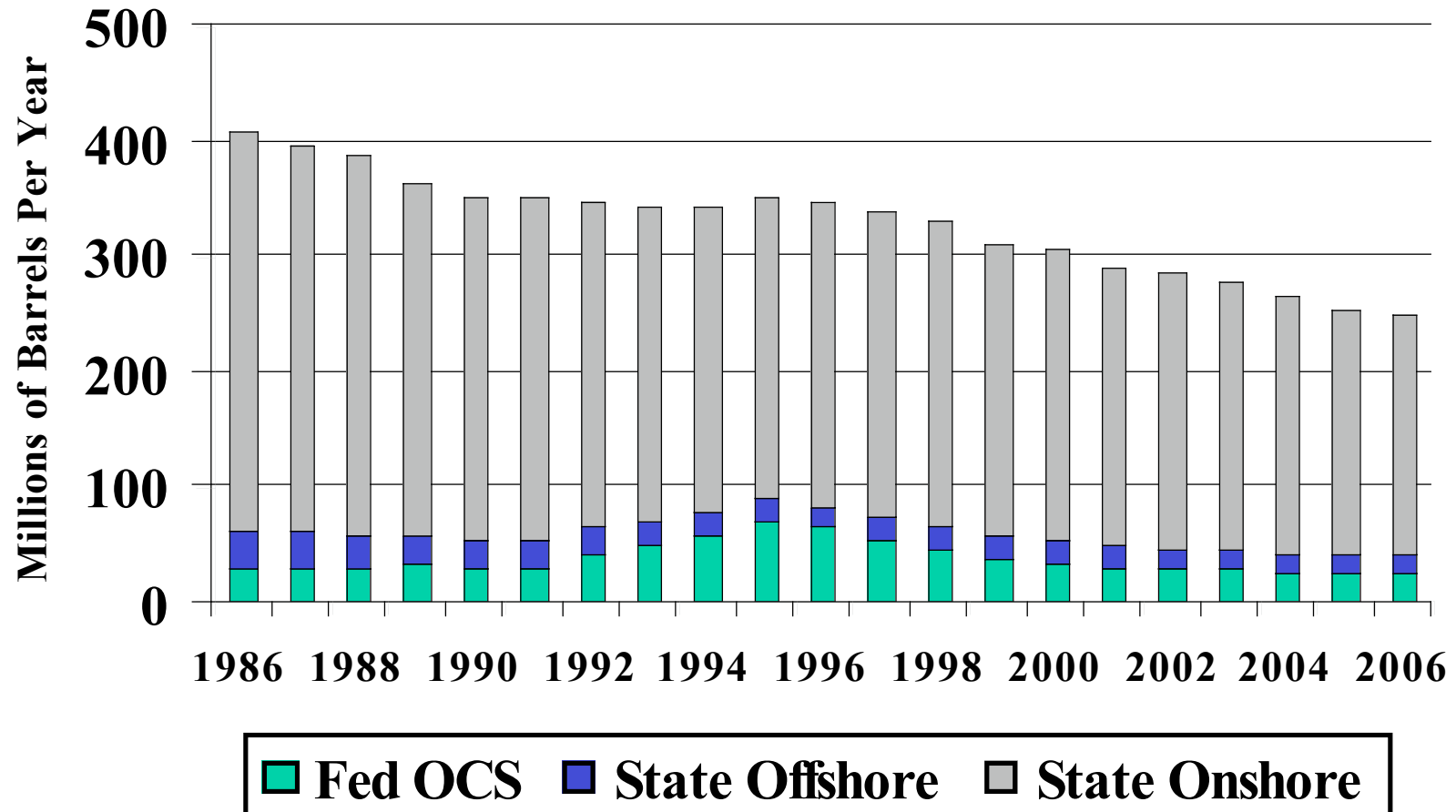
## United States Oil Production 1986 to 2006

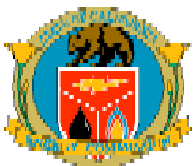


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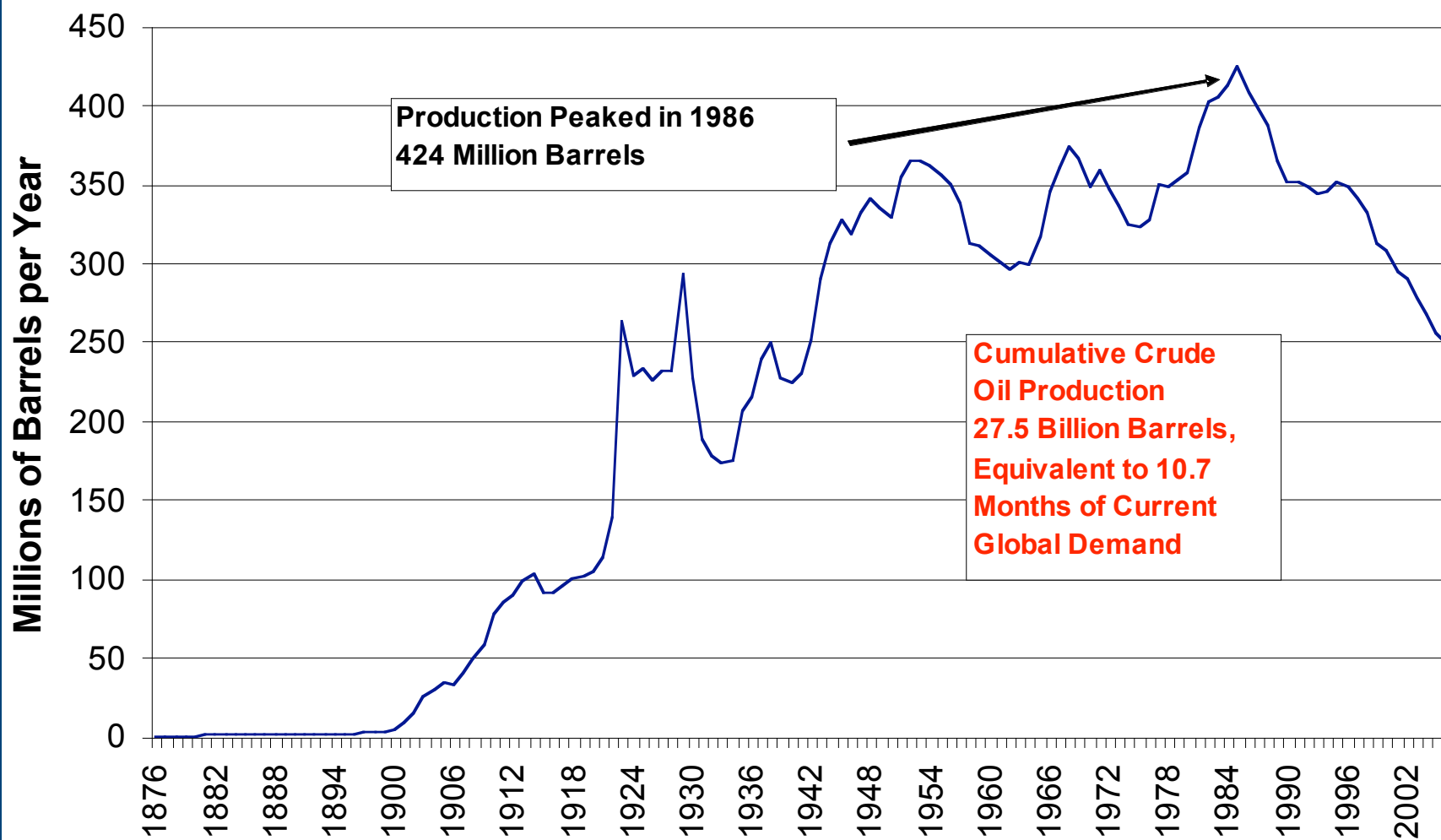


## California Oil Production 1986 to 2006





## California Oil Production 1876 to 2006

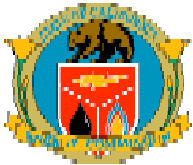


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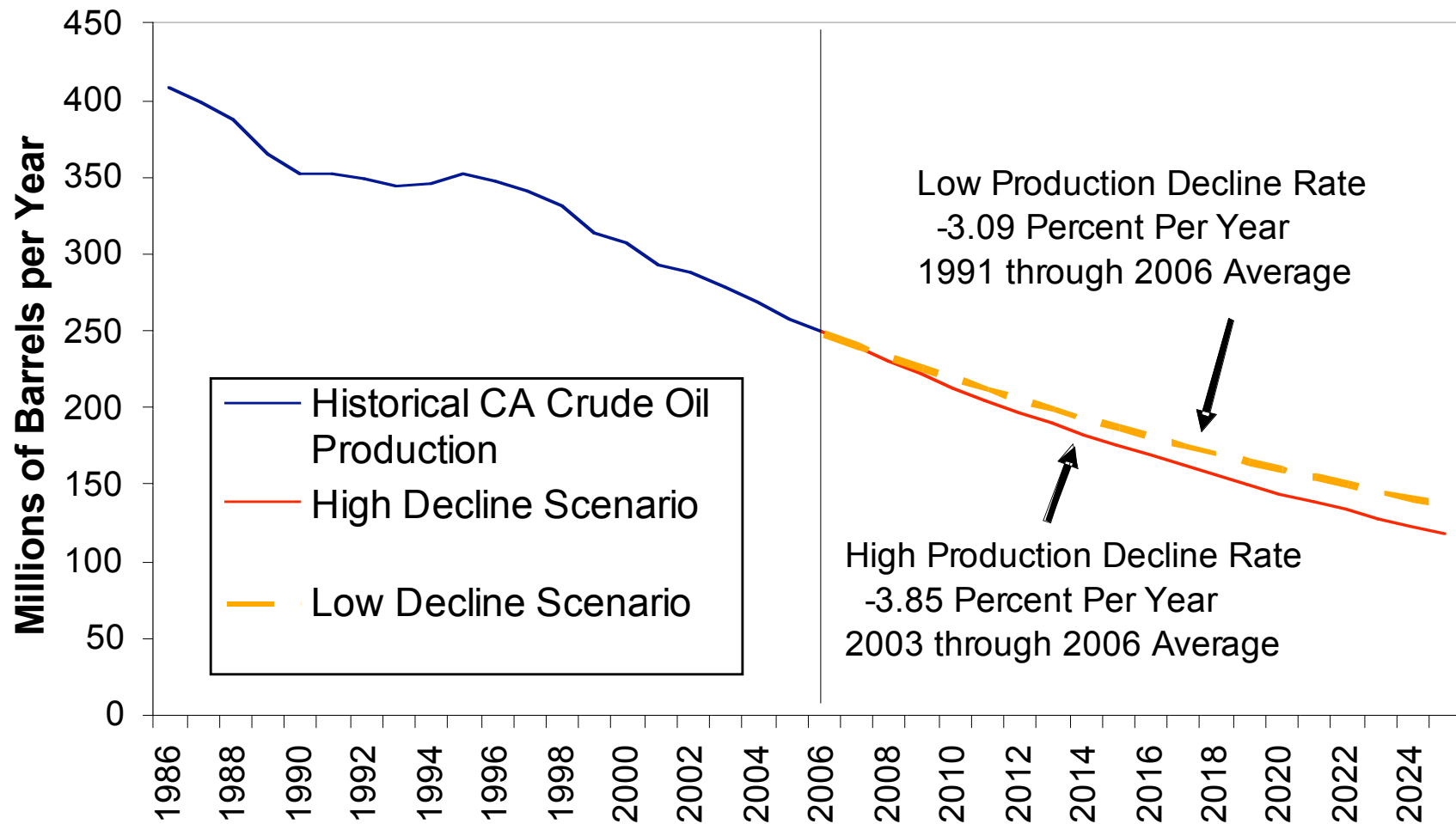


## Recent Crude Oil Production Trends

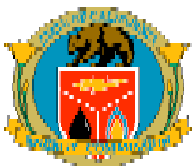
- 2006 U.S. crude oil production 1.87 billion barrels or 5.1 million barrels per day
- California crude oil production has declined 39% since 1986, Alaska 60% and the rest of U.S. by 35%
- Declining domestic oil production will need to be replaced with increased imports of crude oil from foreign sources
- Growing demand for foreign oil will need to be accommodated:
  - Expansion of marine facilities' import capacity
  - New crude oil pipeline capacity between Canada and U.S.
- Delay or impediment of these types of expansion projects could place at risk the ability of domestic refiners to operate at or near maximum transportation fuel production levels
- What is the outlook for California crude oil production & imports?



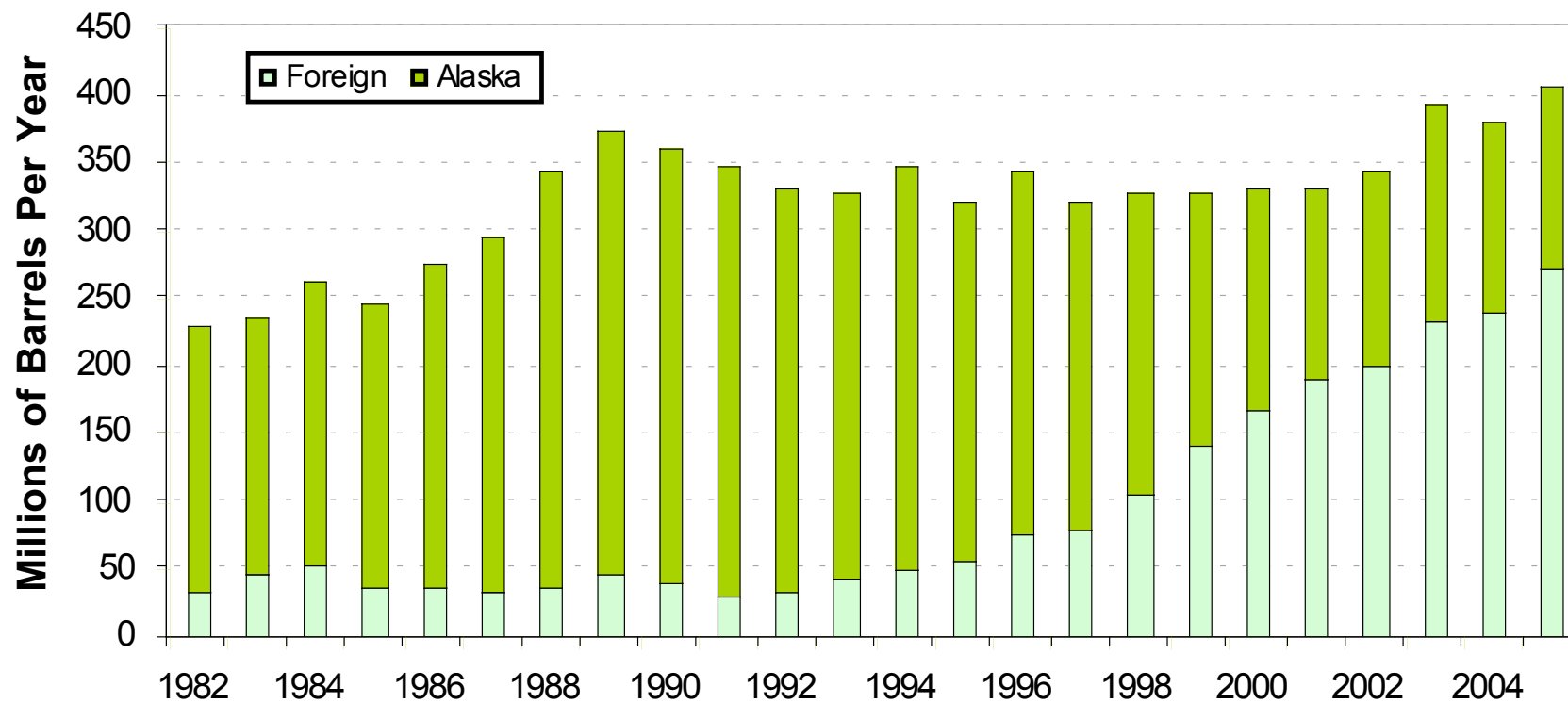
## California Crude Oil Production Decline Forecast 2007-2025



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## California Crude Oil Imports 1982 through 2005



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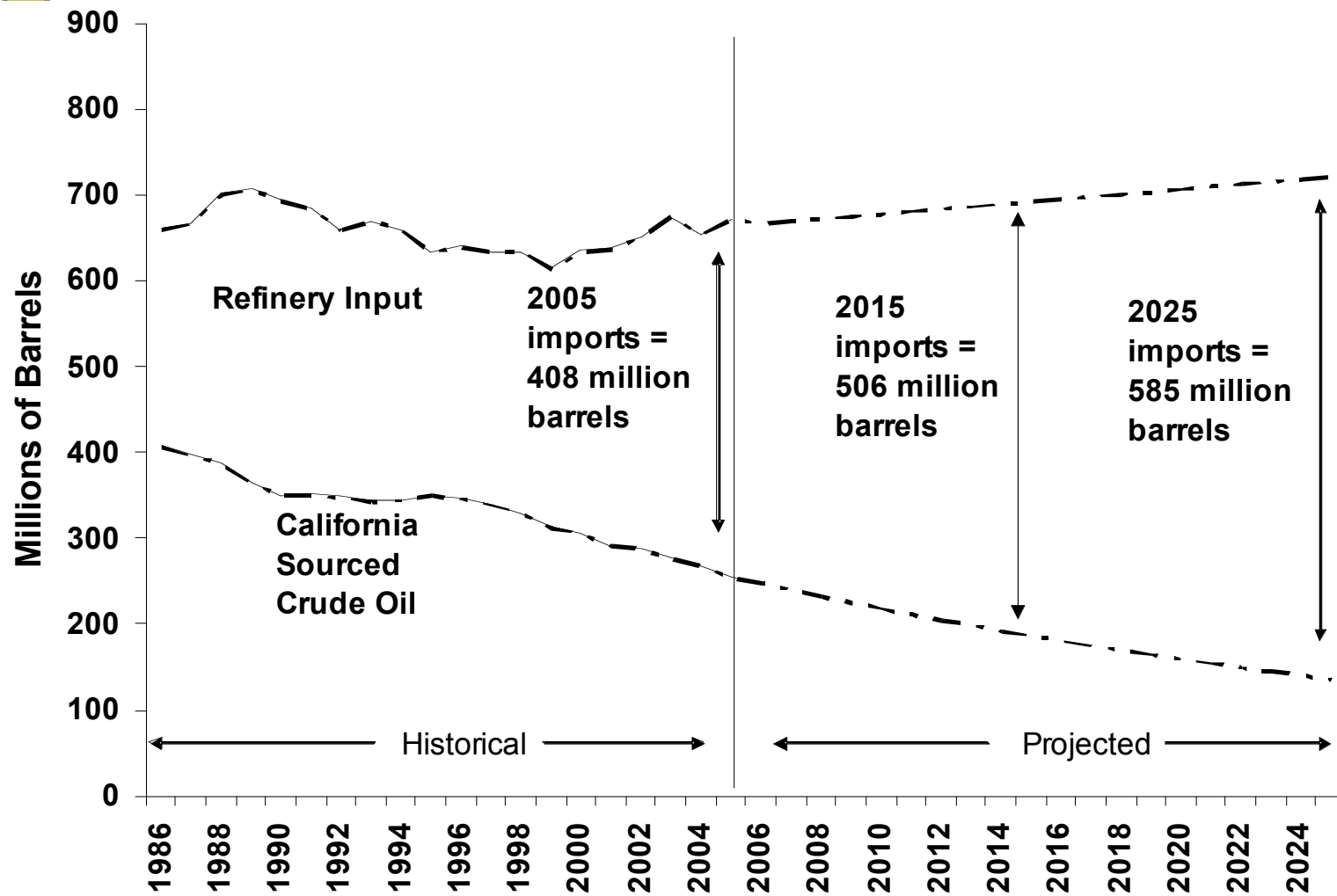


## California Crude Oil Imports – Historical

- Imports of crude oil have increased as California crude production fell and refineries processed additional oil
- Total imports of crude oil have increased 18% between 1996 and 2005
- Imports of Alaska crude oil declined a total of 50% between 1996 and 2005
- The largest increase has been for foreign crude oil imports
  - 15.6% per year increase
- What is the outlook for crude oil imports for California and what are the primary factors influencing the forecasts?



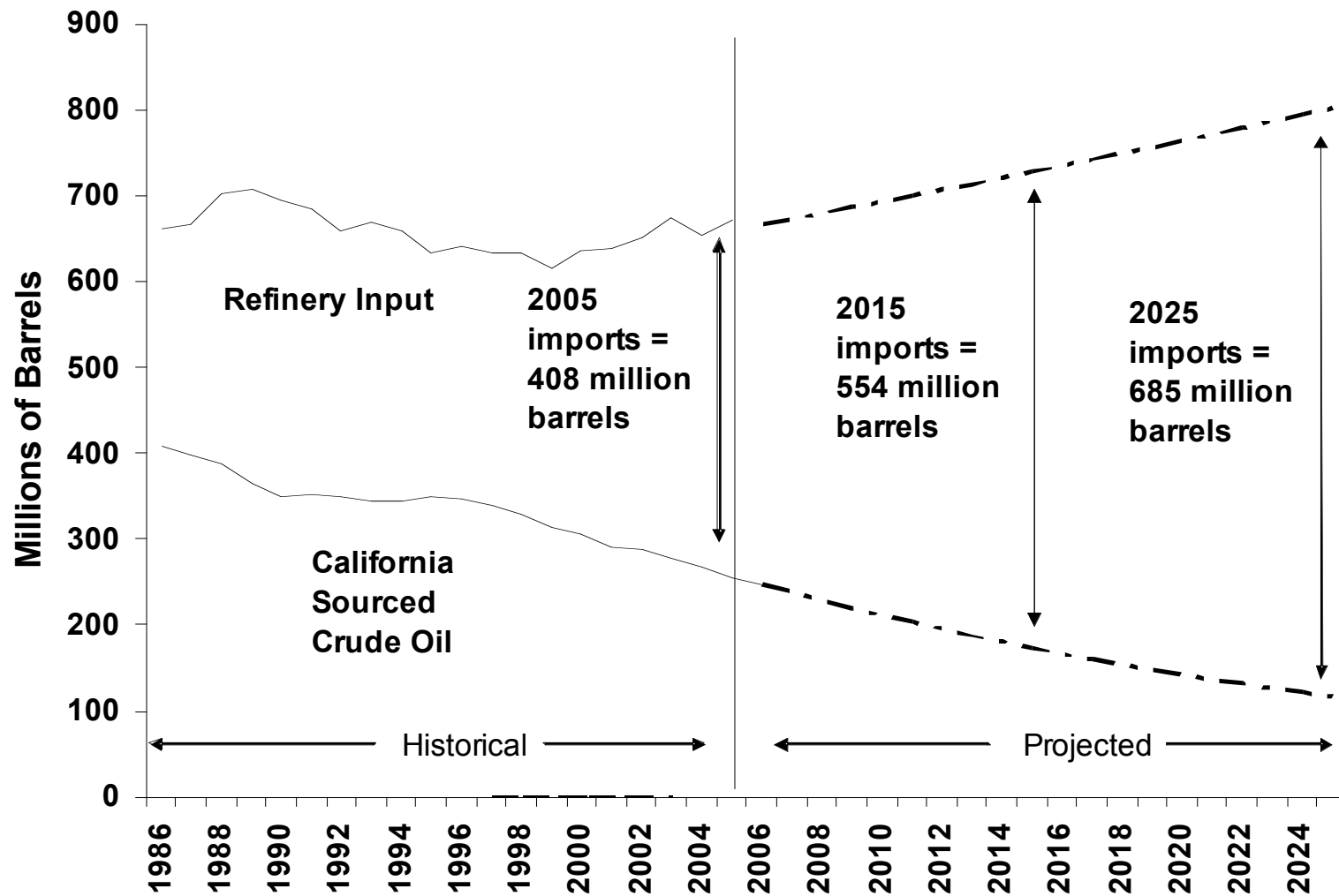
## California Crude Oil Imports – Low Forecast



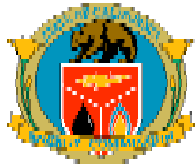
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## California Crude Oil Imports – High Forecast



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## California Crude Oil Imports - Forecast

- Crude oil imports are forecast to increase in California due to:
  - Continuing decline of local crude oil production
  - Gradual expansion of the capacity of California refineries to process crude oil – referred to as “refinery creep”
- The lower estimate for increased crude oil imports assumes that crude oil production declines at a slower pace (3.1% per year) & expansion of distillation capacity is at a smaller rate (0.4% per year)
- The higher estimate for incremental crude oil imports assumes that the production of California crude oil declines at a steeper pace (3.8% per year), while refiners expand distillation capacity at a higher rate (nearly 1% per year)



## Crude Oil Imports – Entire State

Incremental California Crude Oil Imports - Millions of Barrels				
Distillation Capacity Growth Rate	Low Rate of Crude Oil Decline - 3.1%		High Rate of Crude Oil Decline - 3.8%	
	2015	2025	2015	2025
0.41 Percent	98	177	110	196
0.70 Percent	116	217	128	236
0.98 Percent	133	258	146	277

- Southern California is forecast to receive 60% of the crude oil imports



## Crude Oil Imports – Southern California

Incremental <b>S. Calif.</b> Crude Oil Imports - Millions of Barrels				
Distillation Capacity Growth Rate	Low Rate of Crude Oil Decline - 3.1%		High Rate of Crude Oil Decline - 3.8%	
	2015	2025	2015	2025
0.41 Percent	59	106	66	118
0.70 Percent	69	130	77	142
0.98 Percent	80	155	88	166

- Southern California crude oil imports are forecast to increase by 59 to 88 million barrels per year by 2015, an average increase of 161 to 240 thousand barrels per day (TBD)
- Longer term, incremental imports of crude oil for the region are forecast at 106 to 166 million barrels per year by 2025, roughly 291 to 455 TBD more than 2005 levels



## California Crude Oil Imports - Summary

- Crude oil imports continue to increase because California crude oil production is declining and refineries are processing greater quantities over time
- Crude oil imports are forecast to increase by 98 to 146 million barrels by 2015, an increase of between 24% and 36% compared to the levels of imported crude oil in 2005
- Reducing the rate of demand growth for traditional transportation fuels (gasoline, diesel, and jet fuels) will not have any appreciable impact on crude oil imports
- Over the longer term, any reduction in demand for traditional fuels will likely result in a decrease of imported clean fuels, rather than a decrease in crude oil processing

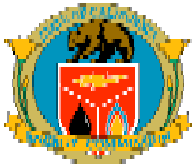




# California's Transportation Fuels Demand

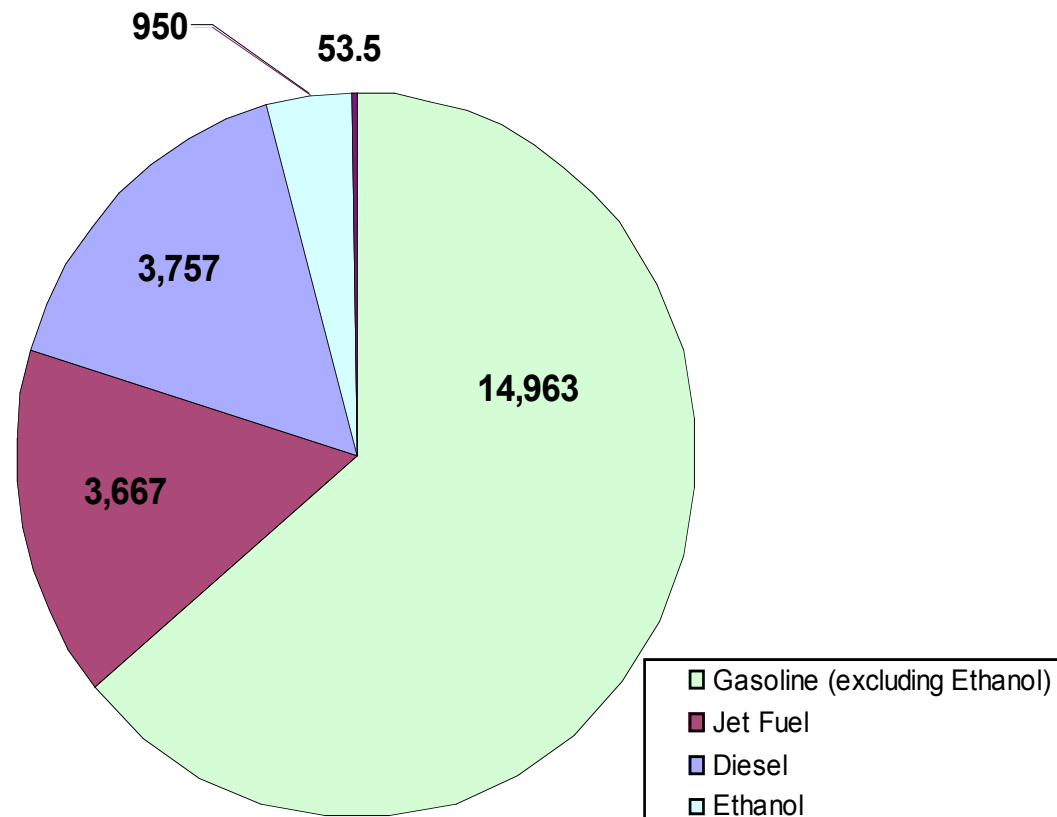


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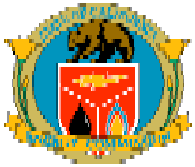


## 5 Percent of California's Transportation Fuels Are From Sources Other Than Gasoline, Diesel & Jet Fuel

**2005 Demand for Petroleum and Alternative Fuels**  
(millions of gallons)

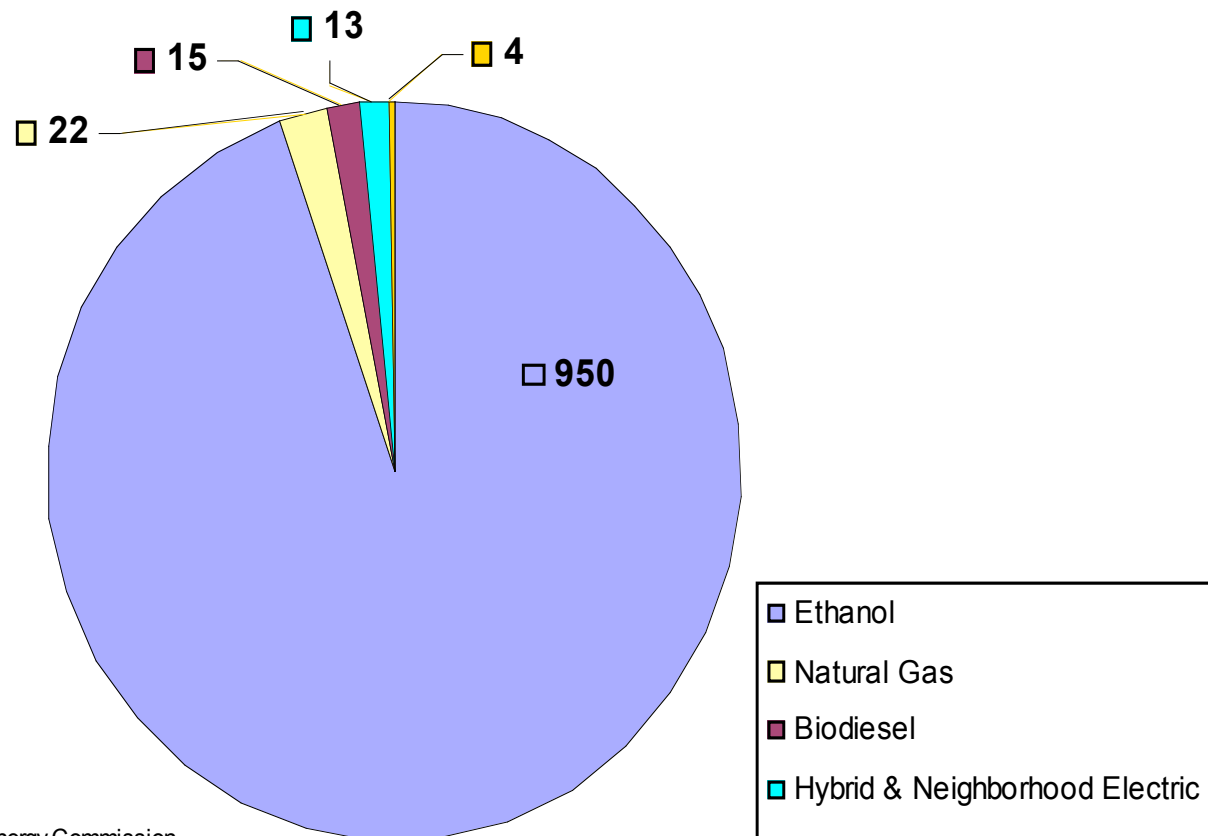


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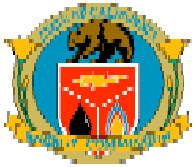


## Alternative Fuels are Dominated by Ethanol Fuel Demand

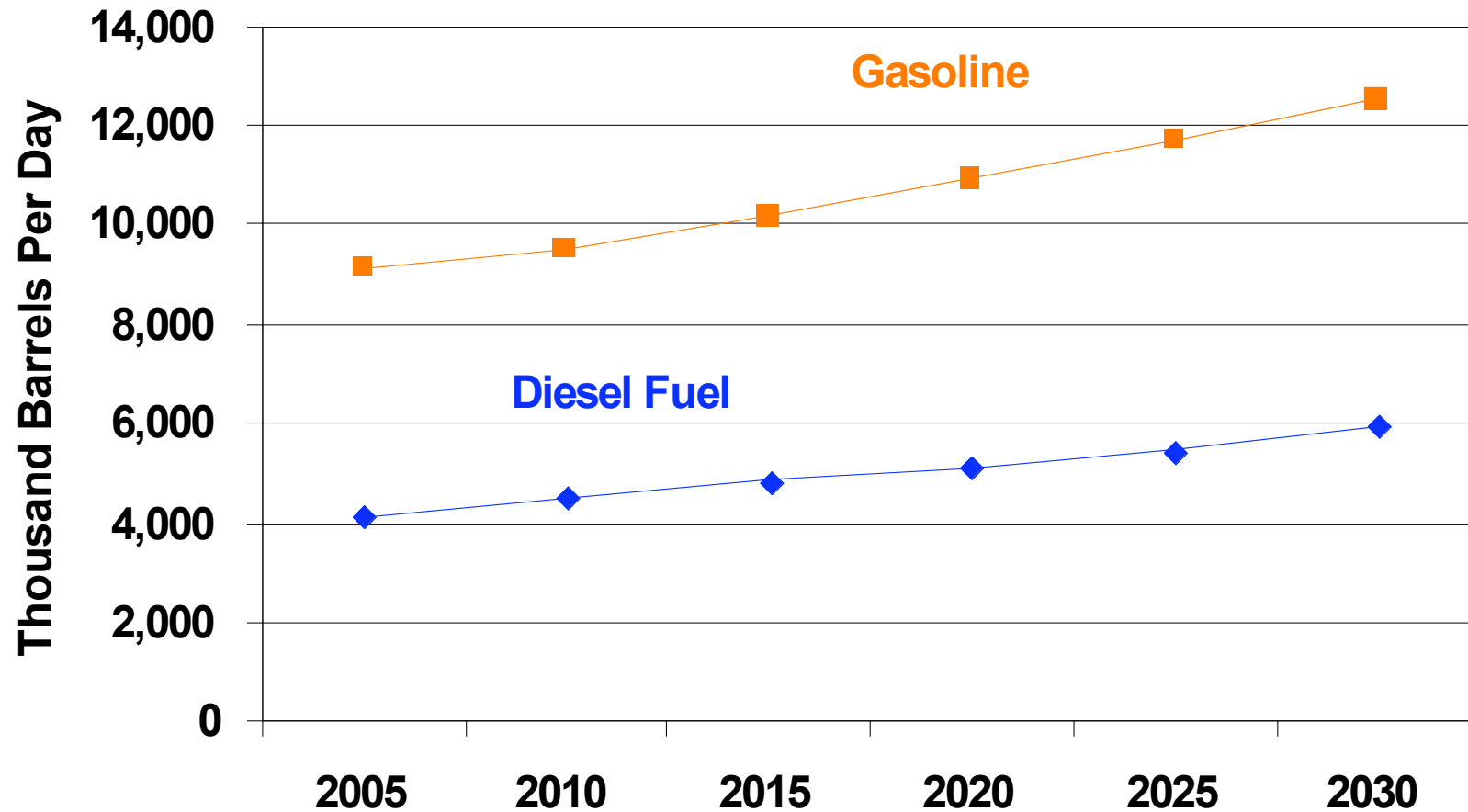
**2005 California Demand for Alternative Fuels  
(Millions of Gallons)**



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## U.S. Transportation Fuel Demand Historical & Forecast



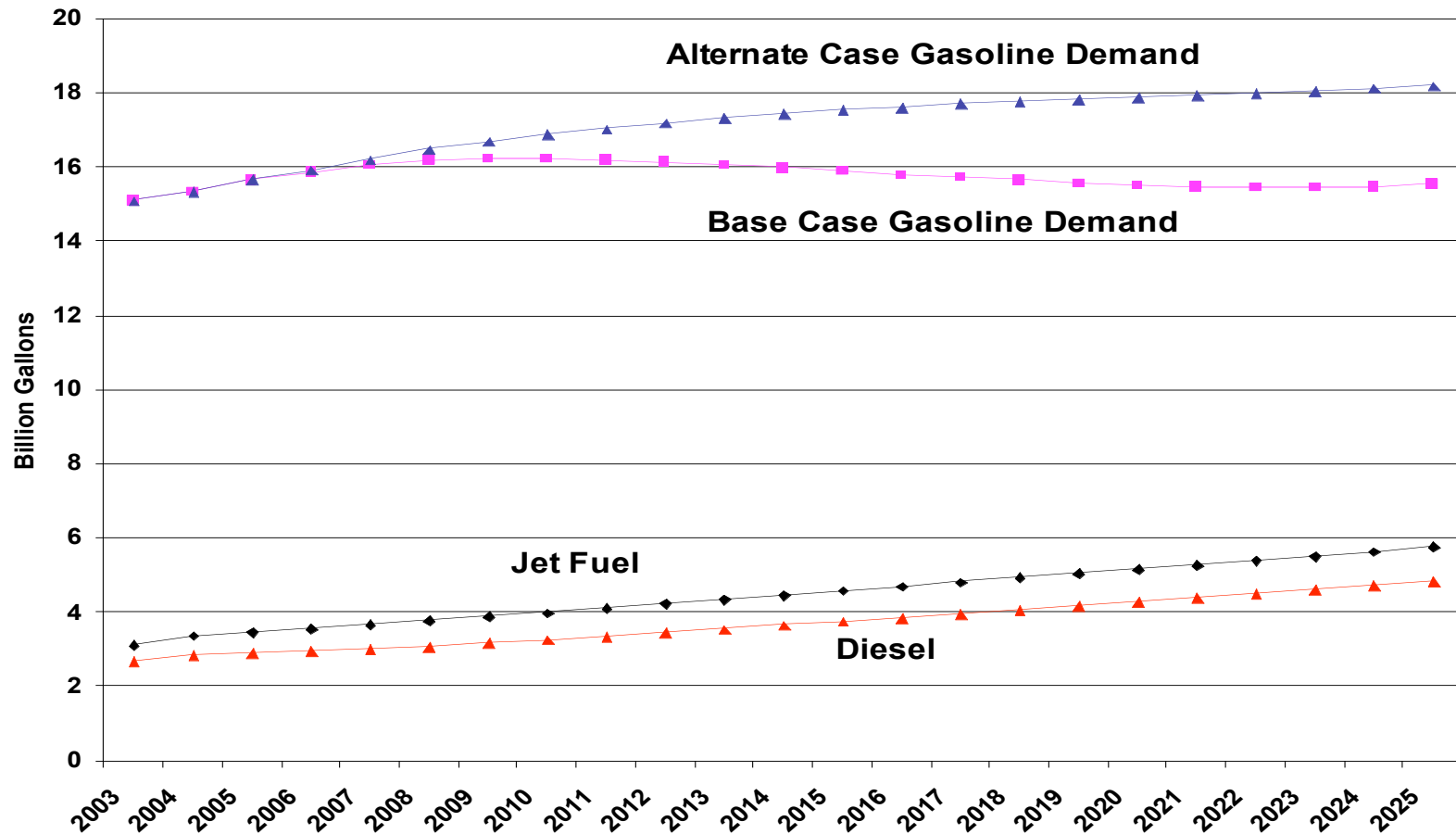
U.S. gasoline demand greater than diesel fuel but forecast to increase at lower rate (1.3 vs. 1.5 percent per year).

Source: EIA Annual Energy Outlook 2007

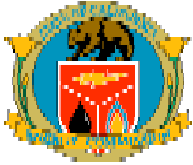
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# California Transportation Fuels Demand Forecast



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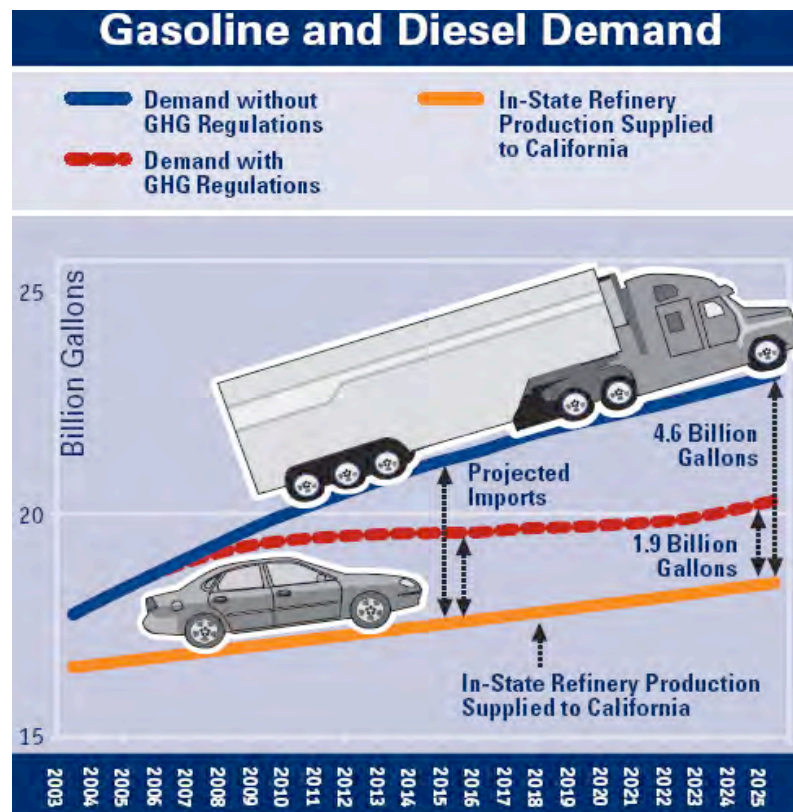


## California Transportation Fuels Demand Forecast

- Base case for gasoline assumes compliance with GHG reduction goals from Pavley legislation
- **Gasoline demand** in California grows by an average of 0.1% per year in the base case forecast and by 0.9% in the alternative forecast from 2005-2025
- **Diesel demand** grows by an average of 2.7% per year in the base case forecast and by 2.9% in the alternative forecast
- **Jet fuel** demand grows by an average of 2.9 % per year
- Average **fuel efficiency** rises by 33% over the forecast period in the base case and by 10% in the alternative case



# California Transportation Fuels Demand & Import Projections

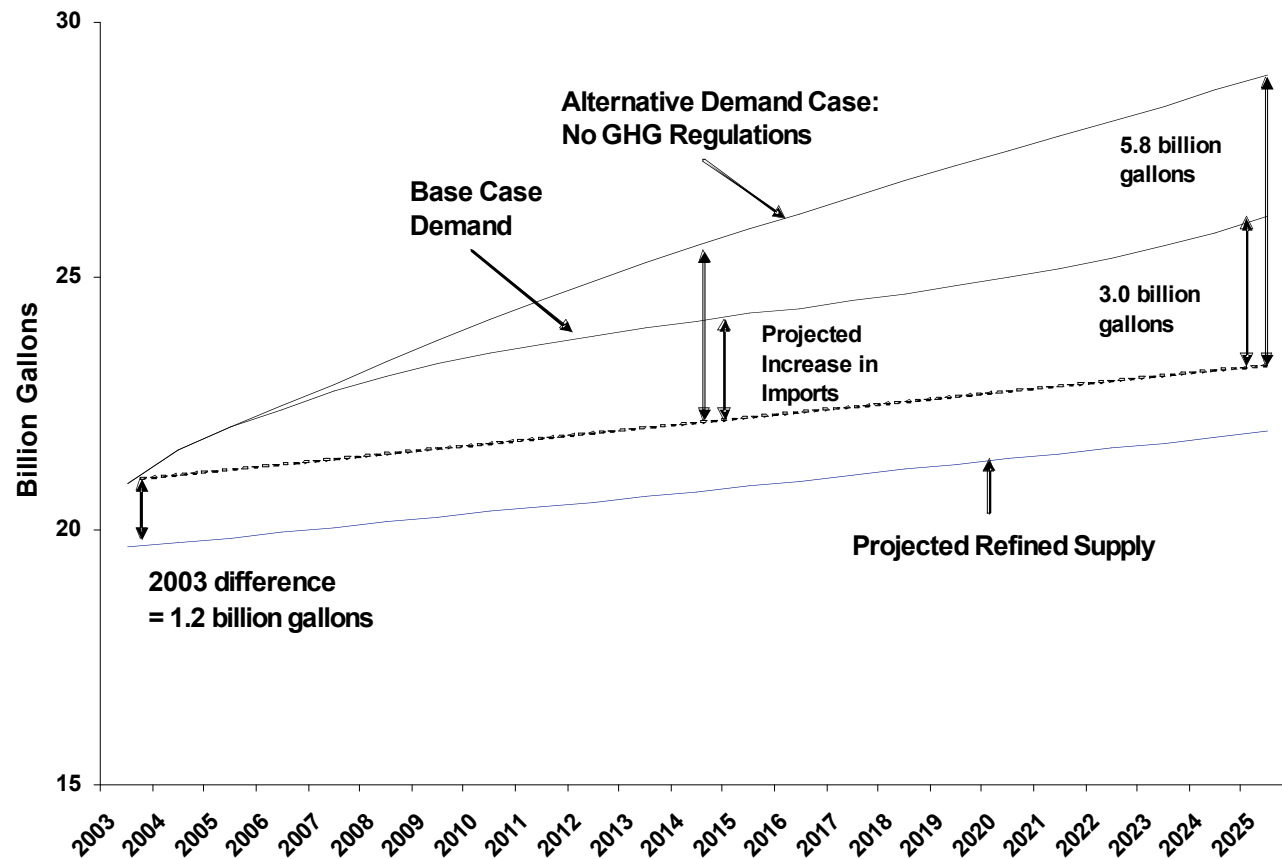


- 80 percent of the projected transportation fuel imports are expected to go through the Ports of Los Angeles and Long Beach
- Demand growth rate for diesel
- fuel is forecast to be higher than that of gasoline
- Reducing dependence on petroleum through increased use of alternative fuels could help ease import demand for clean products over the longer-term, but have little impact on crude oil imports





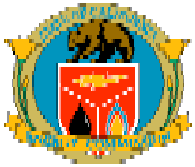
## Clean Fuels Imports - Forecast



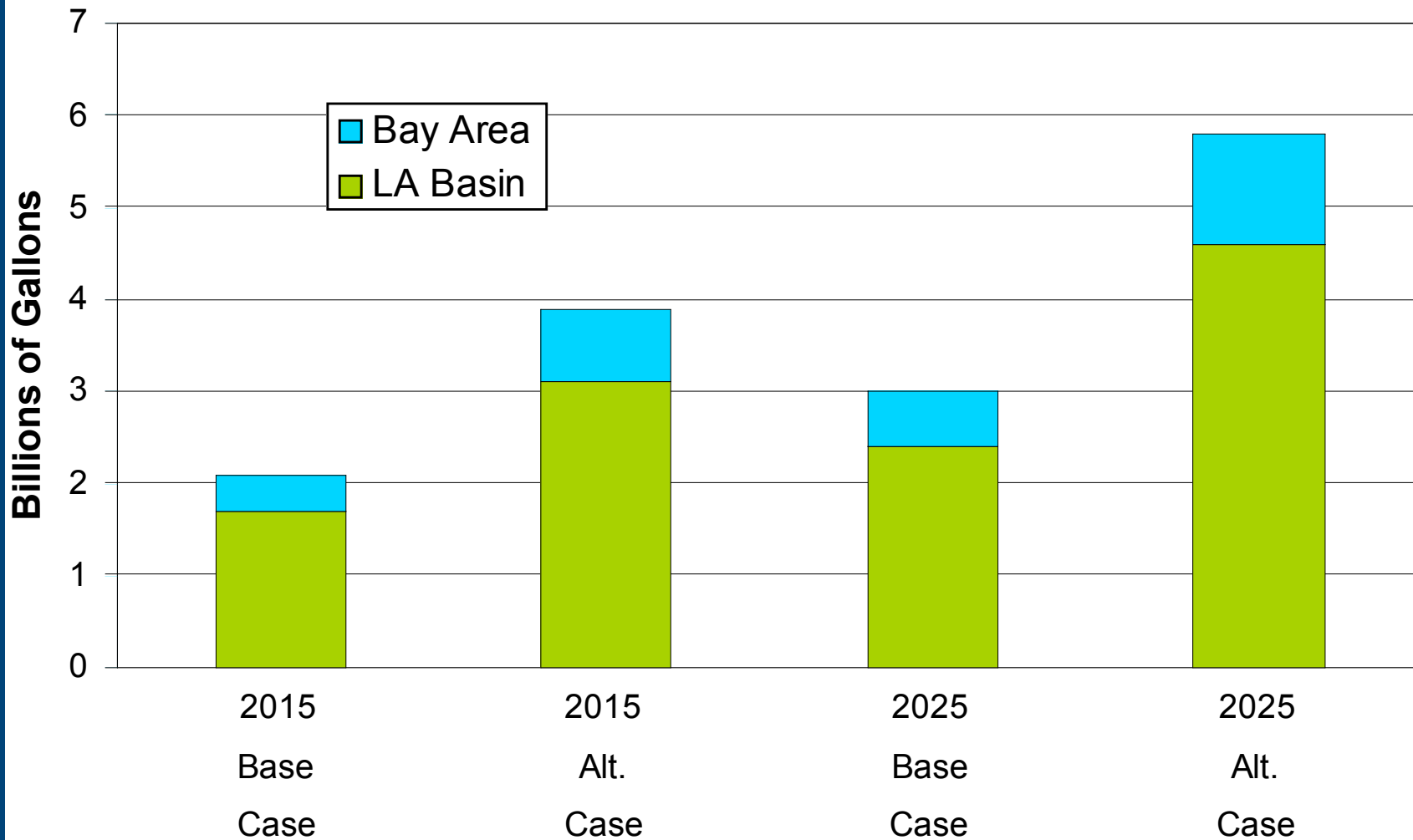


## Clean Fuels Imports - Forecast

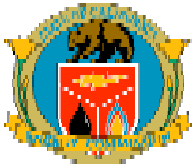
- Annual production increase by California refiners, or “refinery creep,” projected to be 0.5%
- Base case demand forecast -- clean fuels imports increase over the 2004 level by
  - 2.1 billion gallons in 2015
  - 3.0 billion gallons in 2025
- Alternative forecast – clean fuels imports increase by
  - 3.9 billion gallons in 2015
  - 5.8 billion gallons in 2025
- Increased use of alternative fuels can reduce the projected imports of gasoline and diesel fuels, but will likely increase the forecasted imports of ethanol and other alternative fuels



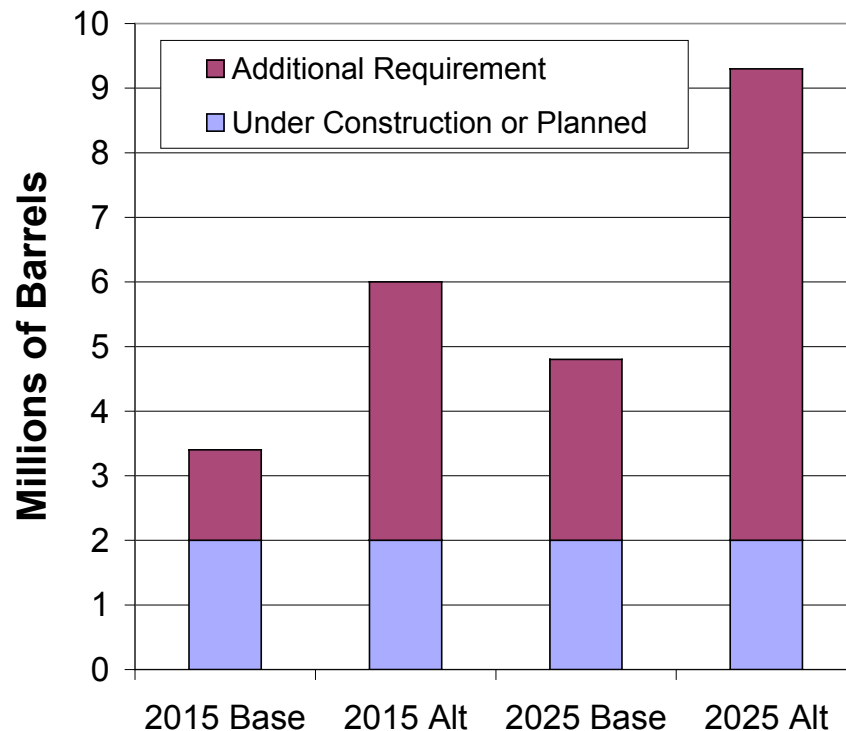
## Clean Fuels - Incremental Import Forecast Los Angeles Basin & Bay Area



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## Additional Storage – Los Angeles Basin



- Assuming existing petroleum infrastructure capacity is retained, an additional 2.8 to 7.3 million barrels of new storage capacity will be needed in the Los Angeles Basin to handle projected clean fuels imports
- If one of the proposed crude oil import terminals is constructed in the Los Angeles Basin, crude oil import capacity should be sufficient to handle the projected imports through 2015



## Petroleum Infrastructure Significance to State

- California's economy is estimated to have generated a gross state product of over \$1.5 trillion during 2005
- Adequate supplies of transportation fuels are a necessary component of ensuring continued movement of goods through and within the state
- Loss of existing petroleum infrastructure assets could diminish access to transportation fuels resulting in:
  - higher costs for California consumers and businesses
  - Increased risk of supply problems
  - Reduced options for re-supply during unplanned outages
  - Increased vulnerability to temporary loss of marine infrastructure assets – less redundancy or surge capability



## Summary

- California refinery production is not expected to keep pace with demand growth for transportation fuels
- California crude oil production forecasted to continue to decline
- Crude oil and clean fuel imports are forecast to increase, especially in the Los Angeles Basin
- Additional petroleum infrastructure projects will be necessary to ensure an adequate crude oil supply for the refineries and an adequate transportation fuel supply for California's consumers
- But potential problems exist for retaining existing petroleum infrastructure, as well as potential constraints to accommodating these future increased imports of crude oil and clean fuels



## Summary

- Spare land to expand petroleum infrastructure, especially in Southern California (Los Angeles and Long Beach), is hard to find
- Increased imports of non-petroleum goods (cargo containers) also require additional land, sometimes in direct competition with petroleum infrastructure
- Even though initiatives are being developed to reduce demand for traditional transportation fuels, these strategies may not appreciably impact demand over the near-term
- Therefore, demand for gasoline, diesel, and jet fuel will likely continue to increase over the next decade or so, requiring an expansion of the capability to accommodate additional imports